

Viking Continuation Mission Support

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This report covers the period from 1 September 1978 through 31 March 1979. It reports on DSN support of Viking Spacecraft activities during the period and continues reporting on DSN Viking Command and Tracking support.

I. Viking Operations

A. Orbiters

The Viking Orbiter 1 (VO-1) spacecraft continued to operate normally during this reporting period as it collected and returned to Earth weather data and Mars photos as well as relaying to Earth data from the two Viking Landers. Viking Orbiter 2 (VO-2) ceased operation on 25 July 1978.

B. Landers

The Viking Landers also continued to operate as expected during this reporting period as they collected and relayed to Earth, via Orbiter 1, Mars weather information and photos.

On 25 October, an attempt was made to turn on Transmitter 2 on board Viking Lander 2. Transmitter 2 had only been operated from Lander touchdown through the first month of the primary mission and for a few weeks in the Extended Mission, at which time it ceased operation during a playback link. A decision was made not to attempt to power up the transmitter again until close to the solar conjunction period during the Viking Continuation Mission because of the limited life expectancy after transmitter turn on. Because the attempt to turn-on transmitter 2 was unsuccessful, and because of the earlier failure of Transmitter 1, all data from VL-2 for the remainder of the continuation Mission will be via the Orbiter-1 relay transmission link.

On 19 February 1979, a command uplink to Viking Lander-1 (VL-1) terminated the Lander Continuation Automatic Mission (LCAM), and loaded a software sequence now referred to as Post-LCAM. The original LCAM sequence automatically transmitted data to Earth at preprogrammed times. The new Post-LCAM sequence requires a command uplink to the Lander-1 spacecraft to turn on the downlink transmitter. Commands transmitted to the Lander are now manually entered in the Command Processor Assembly (CPA) at a Deep Space Station (DSS) prior to the start of a Lander pass. Prior to the Post-LCAM, commands were remotely sent to the DSS CPA from the Mission Computer and Control Center (MCCC) at JPL. Figure 1 shows a typical Lander Pass in support of the Post-LCAM.

On 6 February 1979, a command uplink to Viking Lander-2 (VL-2) terminated the VL-2 LCAM sequence and loaded into the spacecraft computer memory the VL-2 Post-LCAM sequence. Since the downlink transmitters onboard VL-2 no longer function, data collected during the VL-2 Post-LCAM must be relayed to the VO-1 spacecraft for transmission to Earth.

During the Post-LCAM, both Lander spacecraft will collect meteorology and imaging data. The VL-1 spacecraft should be capable of returning Mars data up through 1990. VL-2 will be able to return data only as long as there is an Orbiter spacecraft.

II. Viking Survey Mission

The Survey Mission is the fourth phase of the Viking Mission, following the Primary Mission (terminated 31 May 1978), the Extended Mission (terminated 31 May 1978), and the Continuation Mission (terminated this reporting period, 25 March 1979). The Orbiter operations in the Survey Mission will terminate 31 October 1979, but the Lander operations could continue until 29 December 1990.

The objective of the Orbiter Survey Mission is to acquire high-resolution contiguous coverage with the Visual Imaging Subsystem (VIS) of a region on the planet that is likely to contain the landing sites for the next Mars mission. The Lander mission objectives are to take advantage of the unique capability of a transponder on a planet surface, to make frequent radio ranging measurements and to conduct a long-duration monitoring of weather conditions and surface changes at the Lander 1 site.

Throughout the Survey Mission, the landers will be in an automatic-mission mode, operating autonomously on the programs that have previously been stored in their on-board computers. Lander 1 will be repointing its high-gain antenna and acquiring and storing imaging, meteorology, and engineering data frequently, and will be ready to transmit these data to Earth every 7 or 8 days in response to a command. Lander 2 will be operating in a similar manner, but as it has no direct downlink capability, its data can be retrieved only through a relay to Orbiter 1 in May and possibly another in November.

Because of pressure from Voyager and Pioneer for Network support, Orbiter 1 was placed in a housekeeping mode with all science instruments powered off at the end of the Continuation Mission. New operating and safing sequences have been stored in the CCS to make the Orbiter as nearly self-sufficient as feasible so that neither uplinks nor downlinks will be required more often than every two weeks. This mode is expected to be continued until a date not yet determined, but probably after 15 July 1979. In the meantime, the only special Orbiter events that have been planned are a small number of

telemetry passes with a 64-m station some time in April to retrieve about 70 VIS pictures still on the tape recorders and the receipt and relay of a data readout from Lander 2 in mid-May.

Science acquisition with Orbiter 1 is expected to resume in July when DSS availability will make a reasonable level of operation feasible. A fairly simple sequence of VIS observations will be carried out, probably daily, for approximately three months. Infrared Thermal Mapper (IRTM) and Mars Atmospheric Water Detector (MAWD) data will be acquired simultaneously with the VIS operations, but few if any special infrared sequences will be run. S- and X-band doppler and ranging may be scheduled simultaneously with Lander-1 direct links.

III. Radio Science

Viking Radio Science activities and experimentation continued during this reporting period. These activities include near-simultaneous Lander/Orbiter ranging, the General Relativity Experiment, and the Solar Corona Experiment. The General Relativity and Solar Corona experiments were conducted during the solar conjunction period of December 1978 through February 1979.

IV. Network Support

Table 1 shows the DSN tracking support for the Viking Continuation Mission from June 1978 through 25 March 1979. Tracking support continued to decrease throughout the continuation mission with a slight increase during the Solar conjunction Radio Science activity in December and January. This reduction in Viking operation activity was anticipated during the continuation mission. An even further reduction in tracking support will occur during the Viking Survey Mission.

Table 2 gives the total number of commands transmitted by the DSN during the Viking Continuation Mission.

References

1. Gillette, R. L., "Viking Extended Mission Support", in *The Deep Space Network Progress Report 42-46*, pp. 29-32, Jet Propulsion Laboratory, Pasadena, California, August 15, 1978.
2. Gillette, R. L., "Viking Extended Mission Support", in *The Deep Space Network Progress Report 42-47*, pp. 15-20, Jet Propulsion Laboratory, Pasadena, California, October 15, 1978.
3. Gillette, R. L., "Viking Continuation Mission Support", in *The Deep Space Network Progress Report 42-48*, pp. 7-11, Jet Propulsion Laboratory, Pasadena, California, December 15, 1978.

Table 1. DSN Viking Continuation Mission tracking support

DSS	1978							1979		
	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
11	^a	2	-	1	-	-	1	-	8	5
	^b	13	-	3	-	-	2	-	32	14
12	-	-	-	-	-	4	2	7	20	8
	-	-	-	-	-	20	5	20	145	23
14	34	14	13	3	9	13	13	23	3	1
	242	89	85	12	48	51	29	45	4	8
42	-	2	1	-	4	-	6	6	8	4
	-	9	3	-	22	-	23	19	39	15
43	46	51	23	28	27	17	23	26	12	1
	346	449	135	188	181	116	188	122	49	8
44	3	-	3	-	-	-	1	1	-	1
	17	-	11	-	-	-	5	2	-	4
61	-	-	1	-	-	-	1	3	2	1
	-	-	5	-	-	-	8	19	7	3
62	3	1	1	-	-	-	1	3	-	2
	33	7	9	-	-	-	8	9	-	7
63	41	40	16	21	18	22	23	8	4	1
	343	291	130	157	114	130	130	53	7	7
Total	128	110	58	53	58	56	71	78	57	24
	982	858	378	360	365	317	398	289	283	89

^aNumber of tracks; the summation of all Viking spacecraft tracked.

^bTrack time: scheduled station support in hours.

Table 2. Number of commands transmitted during the Viking Continuation Mission

DSS	1978							1979		
	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
11	6	0	-	0	-	-	0	0	1111	3
12	-	-	-	-	-	1	0	17	531	3
14	1214	870	562	0	2	694	149	0	0	4
42	0	0	0	-	0	-	0	0	1006	458
43	1567	791	7	70	252	648	1914	1141	419	8
44	0	-	30	-	-	-	332	0	-	0
61	0	-	0	-	-	-	0	15	0	0
62	960	0	683	-	-	-	0	15	-	5
63	2451	2984	2073	4988	3376	2690	8	53	3	4
Total	6198	4645	3355	5058	3630	4032	2403	1241	3070	485

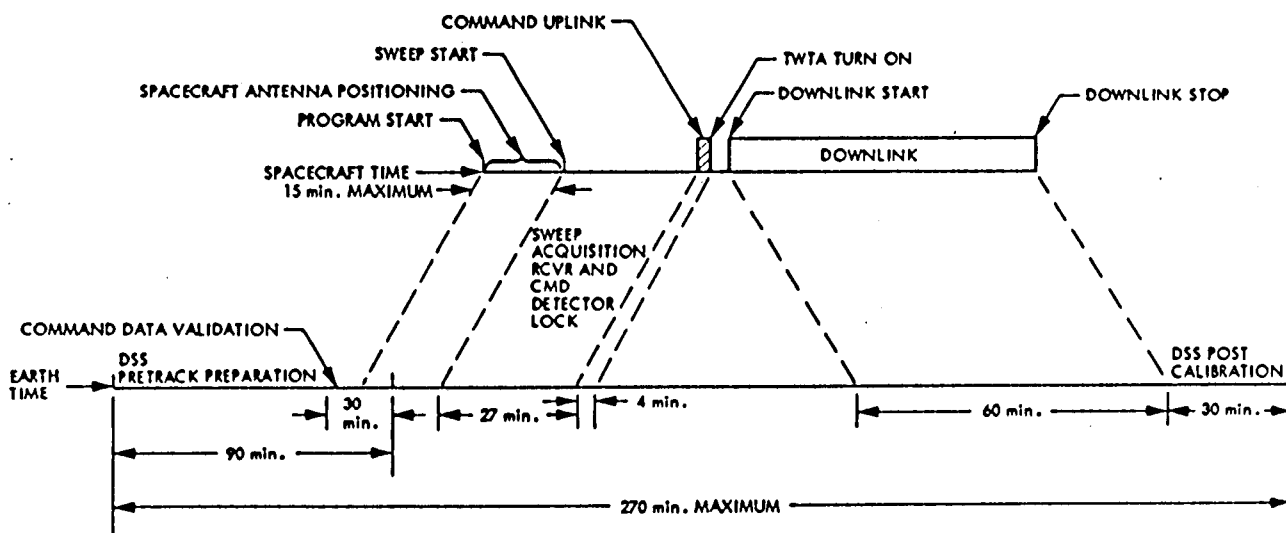


Fig. 1. Typical Lander pass